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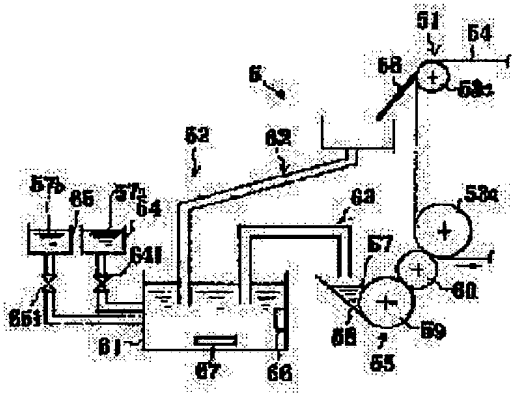
(71)Applicant : RICOH CO LTD
(72)Inventor : KOSUGI HIDEKI
YOSHINO YOSHIE

(54) LIQUID DEVELOPING DEVICE

(57)Abstract:
PROBLEM TO BE SOLVED: To form an image with good quality and also to effectively utilize liquid developer by adequately keeping the concentration of the liquid developer used in developing to fixed concentration.
SOLUTION: The viscosity U of the liquid developer inside a developer storage tank 61 to which the liquid developer recovered from a developing belt 54 is added is detected; the liquid developer with high concentration and the liquid developer with low concentration are supplied when the viscosity U of the liquid developer exceeds an allowable viscosity range, so that the viscosity U of the liquid developer inside the tank 61 becomes initial viscosity Uo the electrostatic latent image formed on the photoreceptor 1 is visualized by the liquid developer always having the viscosity in the allowable viscosity range, and the image with the good quality can be stably formed.



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* NOTICES *

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2. **** shows the word which can not be translated.
3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]
[Claim 1] The liquid-development agent of high viscosity which distributed the development particle in the developer solvent which consists of an insulating liquid at high concentration is applied to a developer support by the thin layer. It is liquid-development equipment which visualizes the electrostatic latent image formed in the image support by the development particle contained in the high-concentration liquid-development agent to which it was applied by the developer support by the thin layer. Liquid-development equipment characterized by having the developer feeder which supplies the liquid-development agent adjusted to the fixed range which set viscosity to a developer application means to apply a liquid-development agent to a developer support, and to form a liquid-development agent thin layer, beforehand.
[Claim 2] Liquid-development equipment according to claim 1 which collects the liquid-development agents which remain to the above-mentioned developer feeder at the developer support after development field passage.
[Claim 3] Liquid-development equipment according to claim 1 or 2 with which the viscosity of the liquid-development agent in the above-mentioned developer feeder is detected, the ratio of a development particle supplies a large liquid-development agent with high viscosity to a developer feeder when the viscosity of a liquid-development agent becomes below the lower limit defined beforehand, and the ratio of a development particle supplies the low liquid-development agent of viscosity to a developer feeder small when it becomes more than the upper limit which the viscosity of a liquid-development agent defined beforehand.
[Claim 4] Liquid-development equipment according to claim 1 or 2 which detects the viscosity of the liquid-development agent in the above-mentioned developer feeder, supplies a development particle to a developer feeder when the viscosity of a liquid-development agent becomes below the lower limit defined beforehand, and supplies the developer solvent which consists of an insulating liquid when it becomes more than the upper limit which the viscosity of a liquid-development agent defined beforehand to a developer feeder.
[Claim 5] the time of setting initial viscosity of the liquid-development agent in the above-mentioned developer feeder to Uo, and setting to Uc viscosity of the developer solvent which consists of an insulating liquid -- the viscosity U of the liquid-development agent in a developer feeder -- {Uo- (Uo-Uc)/2} -- <U< {Uo+ (Uo-Uc)/2}
Liquid-development equipment according to claim 3 or 4 adjusted so that it may become ******.

[Claim 6] Liquid-development equipment according to claim 5 which agitates the liquid-development agent in the above-mentioned developer feeder, and is made into uniform viscosity.

[Translation done.]

* NOTICES *

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[The technical field to which invention belongs] This invention relates to homogenization of the liquid-development equipment which develops the electrostatic latent image formed by the electrophotography method etc. using hyperviscosity and a high-concentration liquid-development agent, especially development.
[0002]
[Description of the Prior Art] The image formation equipment which visualizes an electrostatic latent image using hyperviscosity and a high-concentration liquid-development agent is indicated by JP,7-239614,A, JP,8-123205,A, etc. This image formation equipment applies the pulley wet liquid which has a mold-release characteristic with a pulley wet liquid application means on a photo conductor front face, and has an inactive dielectric and light-transmission nature chemically by uniform thickness, after being uniformly charged with an electrification means in a photo conductor front face. Then, according to image data, a photo conductor front face is exposed by the write-in means, an electrostatic latent image is formed, and it visualizes with liquid-development equipment.
[0003] Liquid-development equipment is what visualizes an electrostatic latent image by the liquid-development agent of high viscosity by which the toner which is a development particle was distributed by high concentration in the developer solvent which consists of insulating liquids, such as for example, dimethylpolysiloxane oil. When the liquid-development agent thin layer which applied the liquid-development agent to the development belt or the developing roller by uniform thickness by the developer application means, and was applied to the development belt or the developing roller approaches a photo conductor and passes along a development field, the toner of a liquid-development agent thin layer transfers to the picture field of a photo conductor, and forms a toner image. The toner image which imprinted the toner image formed in the photo conductor to the transfer paper with the imprint means, and was imprinted to the transfer paper is established, and a picture is formed. The toner and pulley wet liquid which remained to the photo conductor after an imprint process end are removed with a cleaning means, remove the charge which remains in the photo conductor by the electric discharge means, and end an image formation process. Moreover, it mixes with the liquid-development agent which remained without the pulley wet liquid applied to the photo conductor adhering to the development belt passing through the development field, or a developing roller, and being used for development. Collect the liquid-development agents and pulley wet liquid adhering to the development belt passing through this development field, or the developing roller for a developer application means, and reuse, or collect on a waste fluid recovery tank and it discards, or the liquid-development agent and pulley wet liquid which were collected are separated, and the separated liquid-development agent is reused.
[0004] If the liquid-development agent and pulley wet liquid adhering to the development belt which passed along the development field as mentioned above, or the developing roller are collected and discarded, a liquid-development agent will become useless and operation cost will become high. Moreover, when separating and reusing a liquid-development agent and pulley wet

liquid, while it may be difficult practically to equip a developer with a separation mechanism, depending on the property of pulley wet liquid, it may be inseparable with a liquid-development agent. Then, it is usually collecting and reusing for the developer application means.
[0005]
[Problem(s) to be Solved by the Invention] Although the toner of a liquid-development agent is consumed according to the existence of a picture, or its ratio when visualizing an electrostatic latent image using a liquid-development agent, the coating weight of a solvent is not so much dependent on the existence of a picture. Usually, although the liquid-development agent which the toner distributed is used into the solvent by the fixed ratio, when an electrostatic latent image with the high ratio of picture area is repeated and developed, for example, compared with consumption of a solvent, consumption of a toner becomes remarkably large, low liquid-development agents are collected for the ratio of a toner by the developer application means to a solvent, and the concentration which is the ratio of the solvent of the liquid-development agent within a developer application means and a toner falls. The concentration of the picture formed when the concentration of a liquid-development agent fell will also fall.
[0006] Conversely, when the development of the low static latent image of the rate of picture surface ratio is repeated, liquid-development agents with the high ratio of a toner will be collected by the developer application means to a solvent, and the concentration which is the ratio of the solvent of the liquid-development agent within a developer application means and a toner will become high. Nonuniformity etc. will arise to the picture concentration developed while the viscosity of a liquid-development agent becomes high, and the coating weight when applying a liquid-development agent to a development belt or a developing roller changes and being hard coming to form the liquid-development agent thin layer of uniform thickness, when the concentration of the liquid-development agent within a developer application means became high, and quality of image will deteriorate.
[0007] It is made in order that this invention may improve this demerit, and while maintaining at suitable fixed concentration the concentration of the liquid-development agent used for development and forming a good picture, it aims at obtaining the liquid-development equipment which can use a liquid-development agent effectively.
[0008]
[Means for Solving the Problem] The liquid-development equipment concerning this invention applies to a developer support the liquid-development agent of high viscosity which distributed the development particle in the developer solvent which consists of an insulating liquid at high concentration by the thin layer. It is liquid-development equipment which visualizes the electrostatic latent image formed in the image support by the development particle contained in the high-concentration liquid-development agent to which it was applied by the developer support by the thin layer. It is characterized by having the developer feeder which supplies the liquid-development agent adjusted to the fixed range. which set viscosity to a developer application means to apply a liquid-development agent to a developer support, and to form a liquid-development agent thin layer, beforehand.
[0009] It is good for the above-mentioned developer feeder to collect the liquid-development agents which remain to the developer support after development field passage.
[0010] Moreover, the viscosity of the liquid-development agent in the above-mentioned developer feeder is detected, when the viscosity of a liquid-development agent becomes below the lower limit defined beforehand, the ratio of a development particle supplies a large liquid-development agent with high viscosity to a developer feeder, and when it becomes more than the upper limit which the viscosity of a liquid-development agent defined beforehand, the ratio of a development particle supplies the low liquid-development agent of viscosity to a developer feeder small.
[0011] When the viscosity of the liquid-development agent in the above-mentioned developer feeder becomes below the lower limit defined beforehand, a development particle is supplied to a developer feeder, and when it becomes more than the upper limit which the viscosity of a liquid-development agent defined beforehand, you may supply the developer solvent which consists of an insulating liquid to a developer feeder.

[0012] Moreover, when initial viscosity of the liquid-development agent in a developer feeder is set to Uo and viscosity of the developer solvent which consists of an insulating liquid is set to Uc, it is desirable to adjust the viscosity U of the liquid-development agent in a developer feeder so that it may become the range of {Uo- (Uo-Uc)/2} <U< {Uo+ (Uo-Uc)/2}.
[0013] Furthermore, it is good to agitate the liquid-development agent in a developer feeder, and to make it uniform viscosity.
[0014]
[Embodiments of the Invention] The liquid-development equipment of this invention has a developer main part and a developer supply unit. A developer main part has the development belt which moves at the same surface migration speed as the surface migration speed of a photo conductor, a developer application means, and a developer cleaning means. A developer supply unit has a developer storage tank, a developer stripping section, a developer feed zone, a high concentration developer feed zone, and a low concentration developer feed zone. In a developer storage tank, it has a viscometer and a churning means, and the liquid-development agent supplied to a developer application means is stored. A developer feed zone supplies the liquid-development agent stored in the developer storage tank to a developer application means. A high concentration developer feed zone stores a high concentration liquid-development agent with high viscosity with the large ratio of a toner, and supplies the stored high concentration liquid-development agent to a developer storage tank. There are few ratios of a toner and a low concentration developer feed zone supplies the low concentration liquid-development agent which viscosity stored the low low concentration liquid-development agent, and has stored to a developer storage tank.
[0015] When developing and visualizing the electrostatic latent image formed in the photo conductor with this liquid-development equipment, the liquid-development agent thin layer of the uniform thickness of a liquid-development agent is formed in a rotating development belt with a developer application means. The electrostatic latent image of a photo conductor is visualized with the toner contained in the liquid-development agent thin layer of the uniform thickness formed in this development belt. The liquid-development agent which remained in the development belt after this development process is removed by the developer cleaning means, and the removed liquid-development agents are collected by the developer storage tank by the developer stripping section of a developer supply unit.
[0016] The developer solvent in the liquid-development agent collected by this developer storage tank may be changed according to the area of the picture which a toner develops to constant-rate consumption always being carried out at a development process, and it may be changing, the ratio, i.e., the concentration, of a toner to the developer solvent of a liquid-development agent collected by the developer storage tank. Then, the viscosity of the liquid-development agent in the developer storage tank with which the liquid-development agent collected from the photo conductor belt with the viscometer in a developer storage tank is added is detected. When the viscosity of the liquid-development agent in a developer storage tank becomes lower than the lower limit of the permission viscosity range It mixes with the high-concentration liquid-development agent which supplied the high-concentration liquid-development agent to the developer storage tank from the high concentration developer feed zone, and was supplied by agitating the liquid-development agent in a developer storage tank with the churning means, and is made uniform viscosity, and the viscosity of the liquid-development agent in a developer storage tank is adjusted to initial viscosity. Moreover, if the viscosity of the liquid-development agent in a developer storage tank becomes higher than the upper limit of the permission viscosity range, a low-concentration liquid-development agent will be supplied to a developer storage tank from a low concentration developer feed zone, and the viscosity of the liquid-development agent in a develop r storage tank will be adjusted to initial viscosity.
[0017] Thus, the viscosity U of the liquid-development agent in the developer storage tank with which the liquid-development agent collected from the development belt is added is detected. Since a high-concentration liquid-development agent or a low-concentration high-concentration liquid-development agent is supplied and viscosity U of the liquid-development agent in a

developer storage tank is made into initial viscosity Uo when the viscosity U of a liquid-development,agent exceeds the permission viscosity range The electrostatic latent image formed in the photo conductor by the liquid-development agent which always has the viscosity of permission viscosity within the limits can be visualized, it is stabilized and a good picture can be formed.

[0018] Moreover, since it agitates with a churning means and viscosity of the liquid-development agent in a developer storage tank is made into uniform viscosity while supplying a high-concentration liquid-development agent or a low-concentration high-concentration liquid-development agent, when the viscosity U of a liquid-development agent exceeds the permission viscosity range, it can prevent concentration nonuniformity etc. arising in the formed picture.

[0019] Furthermore, if threshold value deltaUo which defines the permission viscosity range (Uo**delta Uo) over initial viscosity Uo sets up with deltaUo= (Uo-Uc) / 2 by setting viscosity of a developer solvent to Uc, it can form an always good picture.

[0020] Moreover, you may supply a toner or a developer solvent instead of a high-concentration liquid-development agent or a low-concentration liquid-development agent.

[0021]

[Example] Drawing 1 is the block diagram of the wet image formation equipment which used the liquid-development equipment of one example of this invention. Wet image formation equipment has the electrification means 2 and the pulley wet liquid application means 3 which have been arranged along with the photo conductor 1 which rotates clockwise, the write-in means 4, liquid-development equipment 5, the imprint means 6, the electric discharge means 7, and the cleaning means 8, as shown in drawing. After a front face is uniformly charged with the electrification means 2, the pulley wet liquid which has a mold-release characteristic with the pulley wet liquid application means 3, and has an inactive dielectric and light-transmission nature chemically is applied to a photo conductor 1 by uniform thickness. The photo conductor 1 with which this front face was uniformly charged and pulley wet liquid was applied is exposed according to image data by the write-in means 4, and an electrostatic latent image is formed. The electrostatic latent image formed in this photo conductor 1 is visualized with liquid-development equipment 5, and the toner image which formed and formed the toner image is imprinted to a transfer paper 9 with the imprint means 6. Discharging the charge which remains in the photo conductor 1 which imprinted the toner image to the transfer paper 9 with the electric discharge means 7, the toner and pulley wet liquid which remained are removed with the cleaning means 7, and go into the following image formation process.

[0022] In the developer solvent which consists of insulating liquids, such as for example, dimethylpolysiloxane oil, liquid-development equipment 5 visualizes an electrostatic latent image by the liquid-development agent of high viscosity by which the toner which is a development particle was distributed by high concentration, and has the developer main part 51 and the developer supply unit 52. The developer main part 51 has the development belt 54 which is wound around two or more rotation rollers 53a-53e, and moves counterclockwise at the same surface migration speed as the surface migration speed of a photo conductor 1, the developer application means 55, and the developer cleaning means 56. As for the development belt 54, the potential between the minimum value of the latent-image potential on a photo conductor 1 and maximum is impressed by the bias impression means (un-illustrating). The developer application means 55 has the developer stores dept. 58, the feed roller 59, and the application roller 60 with which the liquid-development agent 57 of the hyperviscosity which distributed the toner was stored into the developer solvent, and forms the liquid-development agent thin layer of uniform thickness in development belt 54 front face. The developer cleaning means 56 collects the liquid-development liquid which remains to the development belt 54 which passed through the development field.

[0023] The developer supply unit 52 has the developer storage tank 61, the developer stripping section 62, the developer feed zone 63, the high concentration developer feed zone 64, and the low concentration developer feed zone 65, as shown in drawing 2 . In the developer storage tank 61, it has a viscometer 66 and the churning means 67, and the liquid-development agent supplied to the developer application means 55 is stored. The developer stripping section 62 sends the

liquid-development liquid collected with the developer cleaning means 56 to the developer storage tank 61. The developer feed zone 63 supplies the liquid-development agent stored in the developer storage tank 61 to the developer application means 55. In order that the high concentration developer feed zone 64 may form the picture of the optimal picture concentration, the ratio of the toner to a developer solvent is adjusted the optimal, and viscosity supplies high concentration liquid-development agent 57a which has stored and stored high concentration liquid-development agent 57a with high viscosity with the large ratio of a toner from the liquid-development agent of Uo to the developer storage tank 61. There are few ratios of a toner than the liquid-development agent of Uo, and, as for the low concentration developer feed zone 65, viscosity supplies low concentration liquid-development agent 57b which viscosity stored low low concentration liquid-development agent 57b, and has been stored to the developer storage tank 61.

[0024] In the control section of the developer supply unit 52, as shown in drawing 3 , it has the criteria viscosity entry section 68, a comparator 69, and the drive control section 70. The criteria viscosity entry section 68 sets up the criteria viscosity range for controlling the liquid-development agent stored in the developer storage tank 61 to proper viscosity, i.e., proper toner content. A comparator 69 compares the viscosity of the liquid-development agent stored in the developer storage tank 61 detected with the viscometer 66 with the criteria viscosity range set up in the criteria viscosity entry section 68, and the viscosity of the liquid-development agent stored in the developer storage tank 61 judges criteria viscosity within the limits or no. The drive control section 70 drives the supply means 641 of the high concentration developer feed zone 64 or the supply means 651 of the low concentration developer feed zone 65, and the churning means 67 by the judgment result of a comparator 69.

[0025] In the liquid-development equipment 5 constituted as mentioned above, in order to form the picture of the optimal picture concentration in the developer storage tank 61 of the developer supply unit 52 at the time of the first stage, the liquid-development agent of the initial viscosity Uo which adjusted the ratio of the toner to a developer solvent the optimal is stored, and this liquid-development agent is supplied to the developer stores dept. 58 of the developer application means 55. When developing and visualizing the electrostatic latent image formed in the photo conductor 1 with this liquid-development equipment 5, the liquid-development agent thin layer of the uniform thickness of the liquid-development agent 57 is formed in the development belt 54 which is rotating counterclockwise with the developer application means 55. The electrostatic latent image of a photo conductor 1 is visualized with the toner contained in the liquid-development agent thin layer of the uniform thickness formed in this development belt 54. When visualizing the electrostatic latent image of this photo conductor 1, a toner adheres only to the picture section of an electrostatic latent image, and the developer solvent which is a carrier adheres to all the fields of a photo conductor 1. The liquid-development agent which remained in the development belt 54 after this development process is removed by the developer cleaning means 56, and the removed liquid-development agents are collected by the developer storage tank 61 by the developer stripping section 62 of the developer supply unit 52.

[0026] The developer solvent in the liquid-development agent collected by this developer storage tank 61 is changed according to the area of the picture which a toner develops to constant-rate consumption always being carried out at a development process. If it may be changing, the ratio, i.e., the concentration, of a toner to the developer solvent of a liquid-development agent collected by the developer storage tank 61, and this collected liquid-development agent is added to the liquid-development agent in the developer storage tank 61 It will change from initial viscosity Uo, the concentration, i.e., the viscosity, of a liquid-development agent in the developer storage tank 61. The ratio of the toner to the viscosity, i.e., the developer solvent, of a liquid-development agent If the picture concentration when visualizing the electrostatic latent image of a photo conductor 1 is influenced directly and the viscosity of the liquid-development agent to supply, the liquid-development agent 55, i.e., the developer application means, in the developer storage tank 61, falls as shown in the property view of the viscosity of drawing 4 , and picture concentration The concentration of the picture formed in the photo conductor 1 also falls, and if the viscosity of a liquid-development agent carries out a

fixed limit fall, the quality of a picture will deteriorate. Moreover, if the viscosity of the liquid-development agent in the developer storage tank 61 becomes high, the coating weight when applying a liquid-development agent will change to the development belt 54 with the developer application means 55, it will be hard coming to form the liquid-development agent thin layer of uniform thickness, and nonuniformity etc. will arise to picture concentration.

[0027] Then, the viscosity U of the liquid-development agent in the developer storage tank 61 with which the liquid-development agent collected from the development belt 54 with the viscometer 66 in the developer storage tank 61 is added is detected to fixed always or time timing, and it sends to a comparator 69. A comparator 69 judges whether the viscosity U of the liquid-development agent in the developer storage tank 61 is over the permission viscosity range (Uo**delta Uo) as compared with the permission viscosity range (Uo**delta Uo) over the viscosity U of the sent liquid-development agent, and the initial viscosity Uo beforehand set as the criteria viscosity entry section 68. A comparator 69 sends the signal which shows whether the viscosity U of a liquid-development agent is lower than the lower limit (Uo-delta Uo) of the permission viscosity range, or higher than (Uo+delta Uo) in a upper limit to the drive control section 70, when the viscosity U of the liquid-development agent in the developer storage tank 61 is over the permission viscosity range (Uo**delta Uo) as a result of this comparison. If the drive control section 70 receives the signal which shows that the viscosity U of a liquid-development agent is lower than the lower limit (Uo-delta Uo) of the permission viscosity range, it drives the supply means 641 of the high concentration developer feed zone 64, will supply high-concentration liquid-development agent 57a to the developer storage tank 61, will drive the churning means 67 simultaneously, will mix the liquid-development agent in the developer storage tank 61 with high-concentration liquid-development agent 57a supplied by agitating, and will make it uniform viscosity. When supplying this high-concentration liquid-development agent 57a, a viscometer 66 is detected and sends the viscosity U of the liquid-development agent in the developer storage tank 61 to a comparator 69. If the viscosity U of the liquid-development agent in the developer storage tank 61 turns into initial viscosity Uo, a comparator 69 will send a supply interruption signal to the drive control section 70, and will stop the drive of the supply means 641 of the high concentration developer feed zone 64. Moreover, if the signal which shows that the viscosity U of a liquid-development agent is higher than the upper limit (Uo+delta Uo) of the permission viscosity range is received, the drive control section 70 will drive the supply means 651 of the low concentration developer feed zone 65, and will supply low-concentration liquid-development agent 57b to the developer storage tank 61. The churning means 67 is driven, the liquid-development agent in the developer storage tank 61 is mixed with low-concentration liquid-development agent 57b supplied by agitating, it is made uniform viscosity, and the viscosity U of the liquid-development agent in the developer storage tank 61 is adjusted to initial viscosity Uo.

[0028] Thus, the viscosity U of the liquid-development agent in the developer storage tank 61 with which the liquid-development agent collected from the photo conductor belt 54 is added is detected. Since high-concentration liquid-development agent 57a or low-concentration liquid-development agent 57b is supplied and viscosity U of the liquid-development agent in the developer storage tank 61 is made into the permission viscosity range (Uo**delta Uo) when the viscosity U of a liquid-development agent exceeds the permission viscosity range (Uo**delta Uo) The electrostatic latent image formed in the photo conductor 1 by the liquid-development agent which always has the viscosity within the permission viscosity range (Uo**delta Uo) can be visualized, it is stabilized and a good picture can be formed. Moreover, since it agitates with the churning means 67 and is made uniform viscosity while supplying high-concentration liquid-development agent 57a or low-concentration liquid-development agent 57b, when the viscosity U of a liquid-development agent exceeds the permission viscosity range (Uo**delta Uo), it can prevent concentration nonuniformity etc. arising in the formed picture.

[0029] Moreover, as it was shown in the property view of the rate of a toner solid content and viscosity of drawing 5 , using viscosity of a developer solvent as Uc, when threshold value deltaUo which defines the permission viscosity range (Uo**delta Uo) over the initial viscosity Uo set as the criteria viscosity entry section 68 set up with deltaUo= (Uo-Uc) / 2, it was able to

form the always good picture.
[0030] Moreover, although the above-mentioned example explained the case where high-concentration liquid-development agent 57a or low-concentration liquid-development agent 57b was supplied when the viscosity U of the liquid-development agent in the developer storage tank 61 with which the liquid-development agent collected from the photo conductor belt 54 is added exceeded the permission viscosity range (Uo**delta Uo) The viscosity U of a liquid-development agent supplies a toner to the liquid-development agent in the developer storage tank 61, when lower than the lower limit (Uo-delta Uo) of the permission viscosity range. When higher than the upper limit (Uo+delta Uo) of the permission viscosity range, you may make it the viscosity U of a liquid-development agent supply the developer solvent of viscosity Uc to the liquid-development agent in the developer storage tank 61.
[0031]
[Effect of the Invention] This invention detects the viscosity of the liquid-development agent in the developer storage tank with which the liquid-development agent collected from the development belt is added, as explained above. Since a high-concentration liquid-development agent or a low-concentration high-concentration liquid-development agent is supplied and viscosity of the liquid-development agent in a developer storage tank is made into initial viscosity when the viscosity of a liquid-development agent exceeds the permission viscosity range The electrostatic latent image formed in the photo conductor by the liquid-development agent which always has the viscosity of permission viscosity within the limits can be visualized, it is stabilized and a good picture can be formed.
[0032] Moreover, since it agitates with a churning means and viscosity of the liquid-development agent in a developer storage tank is made into uniform viscosity while supplying a high-concentration liquid-development agent or a low-concentration high-concentration liquid-development agent, when the viscosity of a liquid-development agent exceeds the permission viscosity range, it can prevent concentration nonuniformity etc. arising in the formed picture.
[0033] Furthermore, threshold value deltaUo which defines the permission viscosity range (Uo**delta Uo) over initial viscosity Uo can form an always good picture by setting up with deltaUo= (Uo-Uc) / 2 by setting viscosity of a developer solvent to Uc.
[0034] Moreover, the viscosity of the liquid-development agent used for development can be easily adjusted by supplying a toner or a developer solvent instead of a high-concentration liquid-development agent or a low-concentration liquid-development agent.

[Translation done.]

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the block diagram of the example of this invention.
[Drawing 2] It is the block diagram of liquid-development equipment.
[Drawing 3] It is the block diagram showing the composition of the control section of a developer supply unit.
[Drawing 4] It is the property view of viscosity and picture concentration.
[Drawing 5] It is the property view of the rate of a toner solid content, and viscosity.
[Description of Notations]
1 Photo Conductor
5 Liquid-Development Equipment
51 Developer Main Part
52 Developer Supply Unit
54 Development Belt
55 Developer Application Means
56 Developer Cleaning Means
61 Developer Storage Tank
62 Developer Stripping Section
63 Developer Feed Zone
64 High Concentration Developer Feed Zone
65 Low Concentration Developer Feed Zone
66 Viscometer
67 Churning Means
68 Criteria Viscosity Entry Section
69 Comparator
70 Drive Control Section

[Translation done.]

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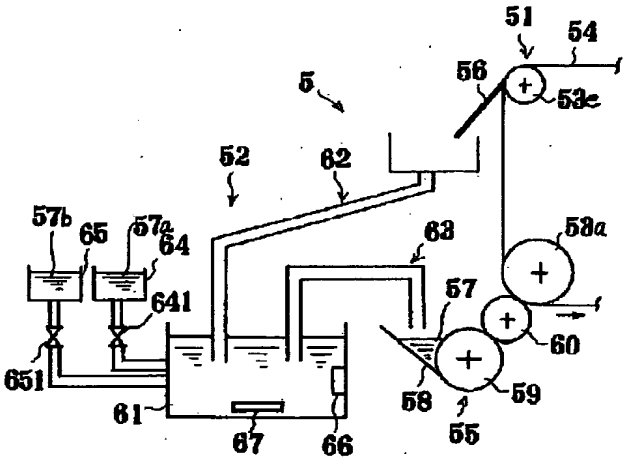
(71)出願人　000006747
株式会社リコー
東京都大田区中馬込１丁目３番６号
(72)発明者　小杉　秀樹
東京都大田区中馬込１丁目３番６号　株式会社リコー内
(72)発明者　吉野　美枝
東京都大田区中馬込１丁目３番６号　株式会社リコー内
(74)代理人　弁理士　小島　俊郎

(54)【発明の名称】　液体現像装置

(57)【要約】
【課題】現像に使用する液体現像剤の濃度を適切な一定濃度に保って良質な画像を形成するとともに液体現像剤を有効に利用する。
【解決手段】現像ベルト５４から回収した液体現像剤が加えられる現像剤貯蔵タンク６１内の液体現像剤の粘度Ｕを検出し、液体現像剤の粘度Ｕが許容粘度範囲を超えたときに高濃度の液体現像剤又は低濃度の液体現像剤を供給して現像剤貯蔵タンク６１内の液体現像剤の粘度Ｕを初期粘度Ｕｏにして、常に許容粘度範囲内の粘度を有する液体現像剤で感光体１に形成された静電潜像を可視化し、良質な画像を安定して形成する。



【特許請求の範囲】

【請求項１】　絶縁性液体からなる現像液溶媒中に顕像化粒子を高濃度に分散した高粘性の液体現像剤を現像剤担持体に薄層で塗布し、像担持体に形成された静電潜像を現像剤担持体に薄層で塗布された高濃度の液体現像剤に含まれる顕像化粒子で可視化する液体現像装置であって、

液体現像剤を現像剤担持体に塗布して液体現像剤薄層を形成する現像剤塗布手段に粘度をあらかじめ定めた一定範囲に調整した液体現像剤を供給する現像剤供給装置を有することを特徴とする液体現像装置。

【請求項２】　上記現像剤供給装置に現像領域通過後の現像剤担持体に残留している液体現像剤を回収する請求項１記載の液体現像装置。

【請求項３】　上記現像剤供給装置内の液体現像剤の粘度を検出し、液体現像剤の粘度があらかじめ定めた下限値以下になったときに顕像化粒子の比率が大きく粘度の高い液体現像剤を現像剤供給装置に供給し、液体現像剤の粘度があらかじめ定めた上限値以上になったときに顕像化粒子の比率が小さく粘度の低い液体現像剤を現像剤供給装置に供給する請求項１又は２記載の液体現像装置。

【請求項４】　上記現像剤供給装置内の液体現像剤の粘度を検出し、液体現像剤の粘度があらかじめ定めた下限値以下になったときに顕像化粒子を現像剤供給装置に供給し、液体現像剤の粘度があらかじめ定めた上限値以上になったときに絶縁性液体からなる現像液溶媒を現像剤供給装置に供給する請求項１又は２記載の液体現像装置。

【請求項５】　上記現像剤供給装置内の液体現像剤の初期粘度をＵｏとし、絶縁性液体からなる現像液溶媒の粘度をＵｃとしたときに、現像剤供給装置内の液体現像剤の粘度Ｕを、

｛Ｕｏ－（Ｕｏ－Ｕｃ）／２｝＜Ｕ＜｛Ｕｏ＋（Ｕｏ－Ｕｃ）／２｝

の範囲になるように調整する請求項３又は４記載の液体現像装置。

【請求項６】　上記現像剤供給装置内の液体現像剤を撹拌して均一な粘度にする請求項５記載の液体現像装置。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】この発明は電子写真方式等で形成された静電潜像を高粘度，高濃度の液体現像剤を用いて顕像化する液体現像装置、特に現像の均質化に関するものである。

【０００２】

【従来の技術】高粘度，高濃度の液体現像剤を使って静電潜像を可視化する画像形成装置が、例えば特開平７－239614号公報や特開平８－123205号公報等に開示されている。この画像形成装置は、感光体表面を帯電手段で均一に帯電してから、感光体表面にプリウェット液塗布手段で離型性を有し化学的に不活性な誘電性と光透過性を有するプリウェット液を均一な厚さで塗布する。その後、書込手段により画像データにしたがって感光体表面を露光して静電潜像を形成し液体現像装置で可視化する。

【０００３】液体現像装置は、例えばジメチルポリシロキサンオイル等の絶縁性液体からなる現像液溶媒中に顕像化粒子であるトナーが高濃度に分散された高粘性の液体現像剤で静電潜像を可視化するものであり、現像剤塗布手段で液体現像剤を均一な厚さで現像ベルトや現像ローラに塗布し、現像ベルトや現像ローラに塗布された液体現像剤薄層が感光体に近接して現像領域を通るとき、液体現像剤薄層のトナーが感光体の画像領域に転移してトナー像を形成する。感光体に形成されたトナー像を転写手段で転写紙に転写し、転写紙に転写したトナー像を定着して画像を形成する。転写工程終了後の感光体に残留したトナーとプリウェット液はクリーニング手段で除去し、感光体に残っている電荷を除電手段によって除去して画像形成工程を終了する。また、現像領域を通った現像ベルトや現像ローラには感光体に塗布したプリウェット液が付着して現像に使用されずに残った液体現像剤と混合する。この現像領域を通った現像ベルトや現像ローラに付着している液体現像剤とプリウェット液を現像剤塗布手段に回収して再利用したり、廃液回収タンクに回収して廃棄したり、回収した液体現像剤とプリウェット液を分離し、分離した液体現像剤を再利用している。

【０００４】上記のように現像領域を通った現像ベルトや現像ローラに付着している液体現像剤とプリウェット液を回収して廃棄すると液体現像剤が無駄になり稼動コストが高くなってしまう。また、液体現像剤とプリウェット液を分離して再利用する場合、現像装置に分離機構を備えることが実用上困難な場合があるとともにプリウェット液の性質によっては液体現像剤と分離できない場合もある。そこで通常は現像剤塗布手段に回収して再利用している。

【０００５】

【発明が解決しようとする課題】液体現像剤を使用して静電潜像を可視化する場合、液体現像剤のトナーは画像の有無あるいはその比率に応じて消費されるが、溶媒の付着量は画像の有無にはさほど依存しない。通常、一定の比率で溶媒中にトナーが分散した液体現像剤を用いているが、例えば画像面積の比率が高い静電潜像を繰り返して現像した場合、溶媒の消費に比べトナーの消費が著しく大きくなり、溶媒に対してトナーの比率が低い液体現像剤が現像剤塗布手段に回収され、現像剤塗布手段内の液体現像剤の溶媒とトナーとの比率である濃度が低下する。液体現像剤の濃度が低下すると形成された画像の濃度も低下してしまう。

【０００６】逆に画像面積比率の低い静電潜像の現像を

繰り返した場合、溶媒に対してトナーの比率の高い液体現像剤が現像剤塗布手段に回収され、現像剤塗布手段内の液体現像剤の溶媒とトナーとの比率である濃度が高くなってしまう。現像剤塗布手段内の液体現像剤の濃度が高くなると液体現像剤の粘度が高くなり、現像ベルトや現像ローラに液体現像剤を塗布するときの付着量が変化して均一な厚さの液体現像剤薄層を形成しにくくなるとともに現像した画像濃度にムラ等が生じて画質が劣化してしまう。

【０００７】この発明はかかる短所を改善するためになされたものであり、現像に使用する液体現像剤の濃度を適切な一定濃度に保って良質な画像を形成するとともに液体現像剤を有効に利用することができる液体現像装置を得ることを目的とするものである。

【０００８】

【課題を解決するための手段】この発明に係る液体現像装置は、絶縁性液体からなる現像液溶媒中に顕像化粒子を高濃度に分散した高粘性の液体現像剤を現像剤担持体に薄層で塗布し、像担持体に形成された静電潜像を現像剤担持体に薄層で塗布された高濃度の液体現像剤に含まれる顕像化粒子で可視化する液体現像装置であって、液体現像剤を現像剤担持体に塗布して液体現像剤薄層を形成する現像剤塗布手段に粘度をあらかじめ定めた一定範囲に調整した液体現像剤を供給する現像剤供給装置を有することを特徴とする。

【０００９】上記現像剤供給装置に現像領域通過後の現像剤担持体に残留している液体現像剤を回収すると良い。

【００１０】また、上記現像剤供給装置内の液体現像剤の粘度を検出し、液体現像剤の粘度があらかじめ定めた下限値以下になったときに顕像化粒子の比率が大きく粘度の高い液体現像剤を現像剤供給装置に供給し、液体現像剤の粘度があらかじめ定めた上限値以上になったときに顕像化粒子の比率が小さく粘度の低い液体現像剤を現像剤供給装置に供給する。

【００１１】上記現像剤供給装置内の液体現像剤の粘度があらかじめ定めた下限値以下になったときに顕像化粒子を現像剤供給装置に供給し、液体現像剤の粘度があらかじめ定めた上限値以上になったときに絶縁性液体からなる現像液溶媒を現像剤供給装置に供給しても良い。

【００１２】また、現像剤供給装置内の液体現像剤の初期粘度をＵｏとし、絶縁性液体からなる現像液溶媒の粘度をＵｃとしたときに、現像剤供給装置内の液体現像剤の粘度Ｕを、｛Ｕｏ－（Ｕｏ－Ｕｃ）／２｝＜Ｕ＜｛Ｕｏ＋（Ｕｏ－Ｕｃ）／２｝の範囲になるように調整することが望ましい。

【００１３】さらに、現像剤供給装置内の液体現像剤を撹拌して均一な粘度にすると良い。

【００１４】

【発明の実施の形態】この発明の液体現像装置は現像装置本体と現像剤供給ユニットを有する。現像装置本体は感光体の表面移動速度と同じ表面移動速度で移動する現像ベルトと現像剤塗布手段及び現像剤クリーニング手段とを有する。現像剤供給ユニットは現像剤貯蔵タンクと現像剤回収部と現像剤供給部と高濃度現像剤供給部及び低濃度現像剤供給部を有する。現像剤貯蔵タンクには粘度計と撹拌手段を有し、現像剤塗布手段に供給する液体現像剤を貯蔵する。現像剤供給部は現像剤貯蔵タンクに貯蔵している液体現像剤を現像剤塗布手段に供給する。高濃度現像剤供給部はトナーの比率が大きく粘度が高い高濃度液体現像剤を貯蔵し、貯蔵している高濃度液体現像剤を現像剤貯蔵タンクに供給する。低濃度現像剤供給部はトナーの比率が少なく粘度が低い低濃度液体現像剤を貯蔵し、貯蔵している低濃度液体現像剤を現像剤貯蔵タンクに供給する。

【００１５】この液体現像装置で感光体に形成された静電潜像を現像して可視化するときは、回動している現像ベルトに現像剤塗布手段で液体現像剤の均一な厚さの液体現像剤薄層を形成する。この現像ベルトに形成された均一な厚さの液体現像剤薄層に含まれるトナーで感光体の静電潜像を可視化する。この現像工程後に現像ベルトに残った液体現像剤は現像剤クリーニング手段により除去され、除去された液体現像剤は現像剤供給ユニットの現像剤回収部により現像剤貯蔵タンクに回収される。

【００１６】この現像剤貯蔵タンクに回収される液体現像剤のなかの現像剤溶媒は現像工程で常に一定量消費されるのに対してトナーが現像する画像の面積に応じて変動し、現像剤貯蔵タンクに回収される液体現像剤の現像剤溶媒に対するトナーの比率すなわち濃度が変化している可能性がある。そこで現像剤貯蔵タンク内の粘度計で感光体ベルトから回収した液体現像剤が加えられる現像剤貯蔵タンク内の液体現像剤の粘度を検出し、現像剤貯蔵タンク内の液体現像剤の粘度が許容粘度範囲の下限値より低くなったら、高濃度現像剤供給部から現像剤貯蔵タンクに高濃度の液体現像剤を供給し、撹拌手段で現像剤貯蔵タンク内の液体現像剤を撹拌して供給された高濃度の液体現像剤と混合して均一な粘度にし現像剤貯蔵タンク内の液体現像剤の粘度を初期粘度に調整する。また、現像剤貯蔵タンク内の液体現像剤の粘度が許容粘度範囲の上限値より高くなったら低濃度現像剤供給部から現像剤貯蔵タンクに低濃度の液体現像剤を供給して現像剤貯蔵タンク内の液体現像剤の粘度を初期粘度に調整する。

【００１７】このように、現像ベルトから回収した液体現像剤が加えられる現像剤貯蔵タンク内の液体現像剤の粘度Ｕを検出し、液体現像剤の粘度Ｕが許容粘度範囲を超えたときに高濃度の液体現像剤又は低濃度の液体現像剤を供給して現像剤貯蔵タンク内の液体現像剤の粘度Ｕを初期粘度Ｕｏにするから、常に許容粘度範囲内の粘度を有する液体現像剤で感光体に形成された静電潜像を可

視化することができ、良質な画像を安定して形成することができる。

【００１８】また、液体現像剤の粘度Ｕが許容粘度範囲を超えたときに高濃度の液体現像剤又は低濃度の液体現像剤を供給するとともに撹拌手段で撹拌して現像剤貯蔵タンク内の液体現像剤の粘度を均一な粘度にするから、形成された画像に濃度ムラ等が生じることを防ぐことができる。

【００１９】さらに、初期粘度Ｕｏに対する許容粘度範囲（Ｕｏ±ΔＵｏ）を定める限界値ΔＵｏは、現像液溶媒の粘度をＵｃとして、ΔＵｏ＝（Ｕｏ－Ｕｃ）／２と設定すると、常に良質な画像を形成することができる。

【００２０】また、高濃度の液体現像剤又は低濃度の液体現像剤の替わりにトナー又は現像液溶媒を供給しても良い。

【００２１】

【実施例】図１はこの発明の一実施例の液体現像装置を使用した湿式画像形成装置の構成図である。湿式画像形成装置は、図に示すように、時計方向に回転する感光体１に沿って配置された帯電手段２とプリウェット液塗布手段３と書込手段４と液体現像装置５と転写手段６と除電手段７及びクリーニング手段８を有する。感光体１は帯電手段２で表面が均一に帯電されたのちプリウェット液塗布手段３で離型性を有し化学的に不活性な誘電性と光透過性を有するプリウェット液を均一な厚さで塗布される。この表面が均一に帯電しプリウェット液が塗布された感光体１を書込手段４により画像データにしたがって露光して静電潜像を形成する。この感光体１に形成された静電潜像を液体現像装置５で可視化してトナー像を形成し、形成したトナー像を転写手段６で転写紙９に転写する。トナー像を転写紙９に転写した感光体１に残っている電荷を除電手段７で除電し、残留したトナーとプリウェット液はクリーニング手段７で除去して次の画像形成工程に入る。

【００２２】液体現像装置５は、例えばジメチルポリシロキサンオイル等の絶縁性液体からなる現像液溶媒中に顕像化粒子であるトナーが高濃度に分散された高粘性の液体現像剤で静電潜像を可視化するものであり、現像装置本体５１と現像剤供給ユニット５２を有する。現像装置本体５１は複数の回転ローラ５３ａ～５３ｅに巻回され感光体１の表面移動速度と同じ表面移動速度で反時計方向に移動する現像ベルト５４と現像剤塗布手段５５及び現像剤クリーニング手段５６とを有する。現像ベルト５４はバイアス印加手段（不図示）により、感光体１上の潜像電位の最小値と最大値の間の電位が印加されている。現像剤塗布手段５５は現像液溶媒中にトナーを分散した高粘度の液体現像剤５７が貯えられた現像剤貯蔵部５８と供給ローラ５９と塗布ローラ６０を有し、現像ベルト５４表面に均一な厚さの液体現像剤薄層を形成する。現像剤クリーニング手段５６は現像領域を通過した現像ベルト５４に残留している液体現像液を回収する。

【００２３】現像剤供給ユニット５２は、図２に示すように、現像剤貯蔵タンク６１と現像剤回収部６２と現像剤供給部６３と高濃度現像剤供給部６４及び低濃度現像剤供給部６５を有する。現像剤貯蔵タンク６１には粘度計６６と撹拌手段６７を有し、現像剤塗布手段５５に供給する液体現像剤を貯蔵する。現像剤回収部６２は現像剤クリーニング手段５６で回収した液体現像液を現像剤貯蔵タンク６１に送る。現像剤供給部６３は現像剤貯蔵タンク６１に貯蔵している液体現像剤を現像剤塗布手段５５に供給する。高濃度現像剤供給部６４は最適画像濃度の画像を形成するため現像液溶媒に対するトナーの比率を最適に調整して粘度がＵｏの液体現像剤よりトナーの比率が大きく粘度が高い高濃度液体現像剤５７ａを貯蔵し、貯蔵している高濃度液体現像剤５７ａを現像剤貯蔵タンク６１に供給する。低濃度現像剤供給部６５は粘度がＵｏの液体現像剤よりトナーの比率が少なく粘度が低い低濃度液体現像剤５７ｂを貯蔵し、貯蔵している低濃度液体現像剤５７ｂを現像剤貯蔵タンク６１に供給する。

【００２４】現像剤供給ユニット５２の制御部には、図３に示すように、基準粘度範囲設定部６８と比較部６９及び駆動制御部７０とを有する。基準粘度範囲設定部６８は現像剤貯蔵タンク６１に貯蔵している液体現像剤を適正な粘度すなわち適正なトナー含有率に制御するための基準粘度範囲を設定する。比較部６９は粘度計６６で検出した現像剤貯蔵タンク６１に貯蔵している液体現像剤の粘度と基準粘度範囲設定部６８で設定された基準粘度範囲とを比較し、現像剤貯蔵タンク６１に貯蔵している液体現像剤の粘度が基準粘度範囲内か否を判定する。駆動制御部７０は比較部６９の判定結果により高濃度現像剤供給部６４の供給手段６４１と低濃度現像剤供給部６５の供給手段６５１のいずれかと撹拌手段６７を駆動する。

【００２５】上記のように構成した液体現像装置５において、現像剤供給ユニット５２の現像剤貯蔵タンク６１には初期時には最適画像濃度の画像を形成するために現像液溶媒に対するトナーの比率を最適に調整した初期粘度Ｕｏの液体現像剤が貯蔵してあり、この液体現像剤が現像剤塗布手段５５の現像剤貯蔵部５８に供給されている。この液体現像装置５で感光体１に形成された静電潜像を現像して可視化するときは、反時計方向に回動している現像ベルト５４に現像剤塗布手段５５で液体現像剤５７の均一な厚さの液体現像剤薄層を形成する。この現像ベルト５４に形成された均一な厚さの液体現像剤薄層に含まれるトナーで感光体１の静電潜像を可視化する。この感光体１の静電潜像を可視化するときに、静電潜像の画像部だけにトナーが付着し、キャリアである現像液溶媒は感光体１の全領域に付着する。この現像工程後に現像ベルト５４に残った液体現像剤は現像剤クリーニン

グ手段５６により除去され、除去された液体現像剤は現像剤供給ユニット５２の現像剤回収部６２により現像剤貯蔵タンク６１に回収される。

【００２６】この現像剤貯蔵タンク６１に回収される液体現像剤のなかの現像剤溶媒は現像工程で常に一定量消費されるのに対してトナーが現像する画像の面積に応じて変動し、現像剤貯蔵タンク６１に回収される液体現像剤の現像剤溶媒に対するトナーの比率すなわち濃度が変化している可能性があり、この回収した液体現像剤が現像剤貯蔵タンク６１内の液体現像剤に加えられると、現像剤貯蔵タンク６１内の液体現像剤の濃度すなわち粘度が初期粘度Ｕｏから変化してしまう。液体現像剤の粘度、すなわち現像剤溶媒に対するトナーの比率は、図４の粘度と画像濃度の特性図に示すように、感光体１の静電潜像を可視化したときの画像濃度に直接影響し、現像剤貯蔵タンク６１内の液体現像剤、すなわち現像剤塗布手段５５に供給する液体現像剤の粘度が低下すると、感光体１に形成された画像の濃度も低下し、液体現像剤の粘度が一定限度低下すると画像の品質が劣化してしまう。また、現像剤貯蔵タンク６１内の液体現像剤の粘度が高くなると、現像剤塗布手段５５で現像ベルト５４に液体現像剤を塗布するときの付着量が変化して均一な厚さの液体現像剤薄層を形成しにくくなり、画像濃度にムラ等が生じてしまう。

【００２７】そこで現像剤貯蔵タンク６１内の粘度計６６で現像ベルト５４から回収した液体現像剤が加えられる現像剤貯蔵タンク６１内の液体現像剤の粘度Ｕを常時又は一定の時間タイミングで検出して比較部６９に送る。比較部６９は送られた液体現像剤の粘度Ｕとあらかじめ基準粘度範囲設定部６８に設定されている初期粘度Ｕｏに対する許容粘度範囲（Ｕｏ±ΔＵｏ）と比較し、現像剤貯蔵タンク６１内の液体現像剤の粘度Ｕが許容粘度範囲（Ｕｏ±ΔＵｏ）を超えているかどうかを判断する。比較部６９は、この比較の結果、現像剤貯蔵タンク６１内の液体現像剤の粘度Ｕが許容粘度範囲（Ｕｏ±ΔＵｏ）を超えているときは、液体現像剤の粘度Ｕが許容粘度範囲の下限値（Ｕｏ－ΔＵｏ）より低いか、上限値を（Ｕｏ＋ΔＵｏ）より高いかを示す信号を駆動制御部７０に送る。駆動制御部７０は液体現像剤の粘度Ｕが許容粘度範囲の下限値（Ｕｏ－ΔＵｏ）より低いことを示す信号を受けると高濃度現像剤供給部６４の供給手段６４１を駆動して現像剤貯蔵タンク６１に高濃度の液体現像剤５７ａを供給し、同時に撹拌手段６７を駆動して現像剤貯蔵タンク６１内の液体現像剤を撹拌して供給された高濃度の液体現像剤５７ａと混合して均一な粘度にする。この高濃度の液体現像剤５７ａを供給しているときに粘度計６６は検出して現像剤貯蔵タンク６１内の液体現像剤の粘度Ｕを比較部６９に送る。比較部６９は現像剤貯蔵タンク６１内の液体現像剤の粘度Ｕが初期粘度Ｕｏになると駆動制御部７０に供給停止信号を送り、高濃度現像剤供給部６４の供給手段６４１の駆動を停止させる。また、駆動制御部７０は液体現像剤の粘度Ｕが許容粘度範囲の上限値（Ｕｏ＋ΔＵｏ）より高いことを示す信号を受けると低濃度現像剤供給部６５の供給手段６５１を駆動して現像剤貯蔵タンク６１に低濃度の液体現像剤５７ｂを供給し、撹拌手段６７を駆動して現像剤貯蔵タンク６１内の液体現像剤を撹拌して供給された低濃度の液体現像剤５７ｂと混合して均一な粘度にし、現像剤貯蔵タンク６１内の液体現像剤の粘度Ｕを初期粘度Ｕｏに調整する。

【００２８】このように、感光体ベルト５４から回収した液体現像剤が加えられる現像剤貯蔵タンク６１内の液体現像剤の粘度Ｕを検出し、液体現像剤の粘度Ｕが許容粘度範囲（Ｕｏ±ΔＵｏ）を超えたときに高濃度の液体現像剤５７ａ又は低濃度の液体現像剤５７ｂを供給して現像剤貯蔵タンク６１内の液体現像剤の粘度Ｕを許容粘度範囲（Ｕｏ±ΔＵｏ）にするから、常に許容粘度範囲（Ｕｏ±ΔＵｏ）内の粘度を有する液体現像剤で感光体１に形成された静電潜像を可視化することができ、良質な画像を安定して形成することができる。また、液体現像剤の粘度Ｕが許容粘度範囲（Ｕｏ±ΔＵｏ）を超えたときに高濃度の液体現像剤５７ａ又は低濃度の液体現像剤５７ｂを供給するとともに撹拌手段６７で撹拌して均一な粘度にするから、形成された画像に濃度ムラ等が生じることを防ぐことができる。

【００２９】また、基準粘度範囲設定部６８に設定する初期粘度Ｕｏに対する許容粘度範囲（Ｕｏ±ΔＵｏ）を定める限界値ΔＵｏは、現像液溶媒の粘度をＵｃとして、図５のトナー固形分率と粘度の特性図に示すように、ΔＵｏ＝（Ｕｏ－Ｕｃ）／２と設定すると、常に良質な画像を形成することができた。

【００３０】また、上記実施例は感光体ベルト５４から回収した液体現像剤が加えられる現像剤貯蔵タンク６１内の液体現像剤の粘度Ｕが許容粘度範囲（Ｕｏ±ΔＵｏ）を超えたときに高濃度の液体現像剤５７ａ又は低濃度の液体現像剤５７ｂを供給した場合について説明したが、液体現像剤の粘度Ｕが許容粘度範囲の下限値（Ｕｏ－ΔＵｏ）より低いときに現像剤貯蔵タンク６１内の液体現像剤にトナーを供給し、液体現像剤の粘度Ｕが許容粘度範囲の上限値（Ｕｏ＋ΔＵｏ）より高いときに現像剤貯蔵タンク６１内の液体現像剤に粘度Ｕｃの現像液溶媒を供給するようにしても良い。

【００３１】

【発明の効果】この発明は以上説明したように、現像ベルトから回収した液体現像剤が加えられる現像剤貯蔵タンク内の液体現像剤の粘度を検出し、液体現像剤の粘度が許容粘度範囲を超えたときに高濃度の液体現像剤又は低濃度の液体現像剤を供給して現像剤貯蔵タンク内の液体現像剤の粘度を初期粘度にするから、常に許容粘度範囲内の粘度を有する液体現像剤で感光体に形成された静

電潜像を可視化することができ、良質な画像を安定して形成することができる。

【００３２】また、液体現像剤の粘度が許容粘度範囲を超えたときに高濃度の液体現像剤又は低濃度の液体現像剤を供給するとともに撹拌手段で撹拌して現像剤貯蔵タンク内の液体現像剤の粘度を均一な粘度にするから、形成された画像に濃度ムラ等が生じることを防ぐことができる。

【００３３】さらに、初期粘度Ｕｏに対する許容粘度範囲（Ｕｏ±ΔＵｏ）を定める限界値ΔＵｏは、現像液溶媒の粘度をＵｃとして、ΔＵｏ＝（Ｕｏ－Ｕｃ）／２と設定することにより、常に良質な画像を形成することができる。

【００３４】また、高濃度の液体現像剤又は低濃度の液体現像剤の替わりにトナー又は現像液溶媒を供給することにより、現像に使用する液体現像剤の粘度を簡単に調整することができる。

【図面の簡単な説明】

【図１】この発明の実施例の構成図である。

【図２】液体現像装置の構成図である。

【図３】現像剤供給ユニットの制御部の構成を示すブロック図である。

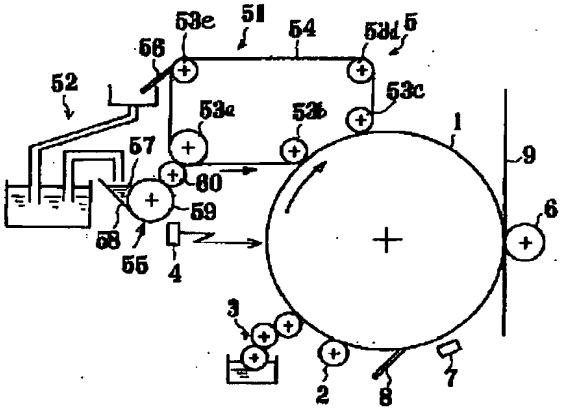
【図４】粘度と画像濃度の特性図である。

【図５】トナー固形分率と粘度の特性図である。

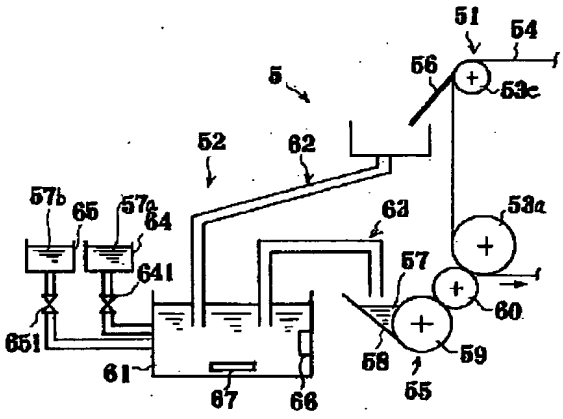
【符号の説明】

１	感光体
５	液体現像装置
５１	現像装置本体
５２	現像剤供給ユニット
５４	現像ベルト
５５	現像剤塗布手段
５６	現像剤クリーニング手段
６１	現像剤貯蔵タンク
６２	現像剤回収部
６３	現像剤供給部
６４	高濃度現像剤供給部
６５	低濃度現像剤供給部
６６	粘度計
６７	撹拌手段
６８	基準粘度範囲設定部
６９	比較部
７０	駆動制御部

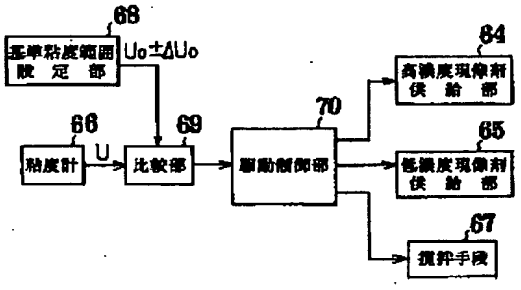
【図１】



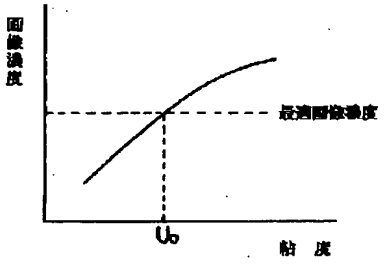
【図２】



【図３】



【図４】



【図５】